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NATIONAL DAM SAFETY PROGRAM. ANTIETAM DAM (NDS PA-332). POTOMAC--ETC(U)
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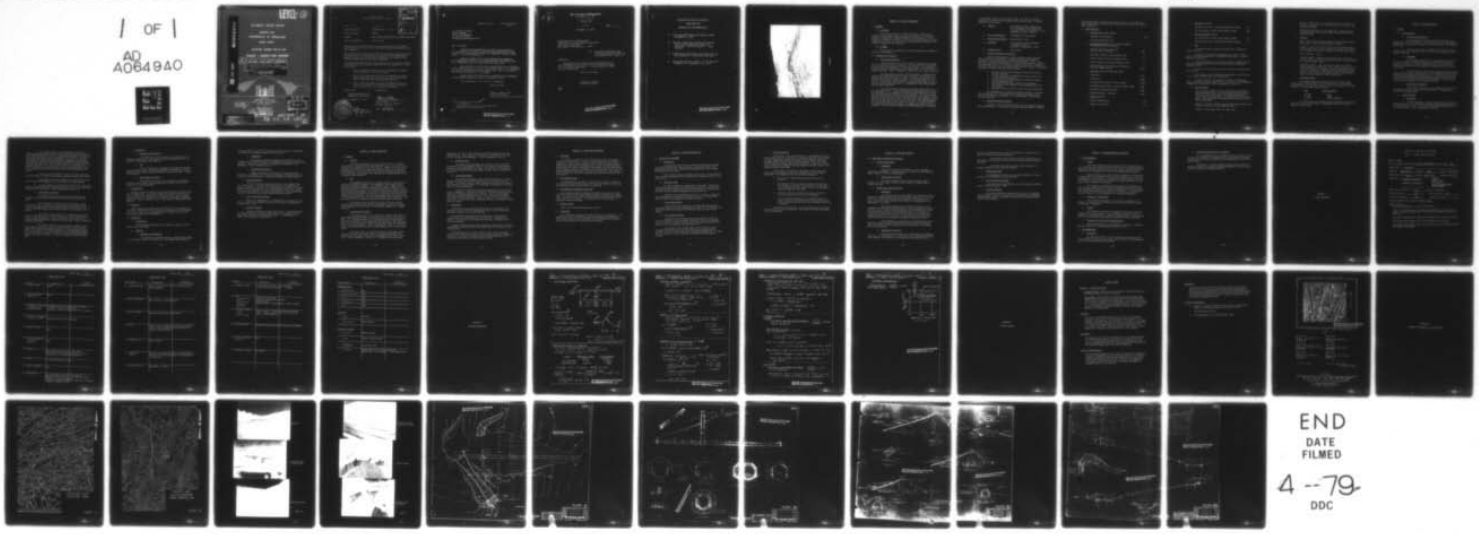

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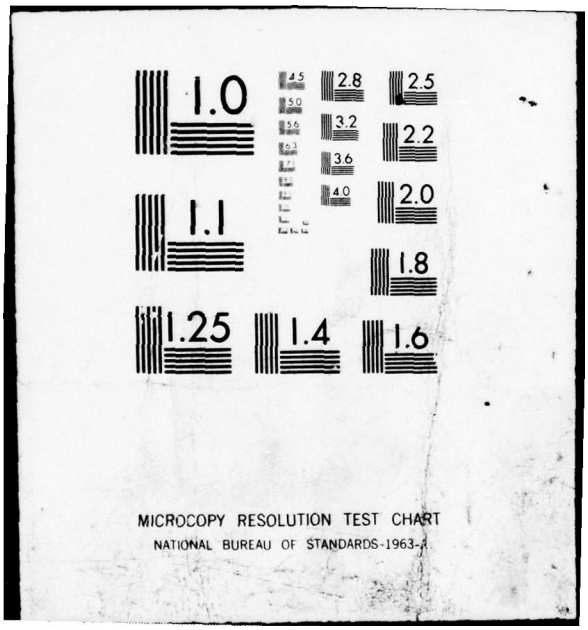
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POTOMAC RIVER BASIN

ANTIETAM DAM

COMMONWEALTH OF PENNSYLVANIA

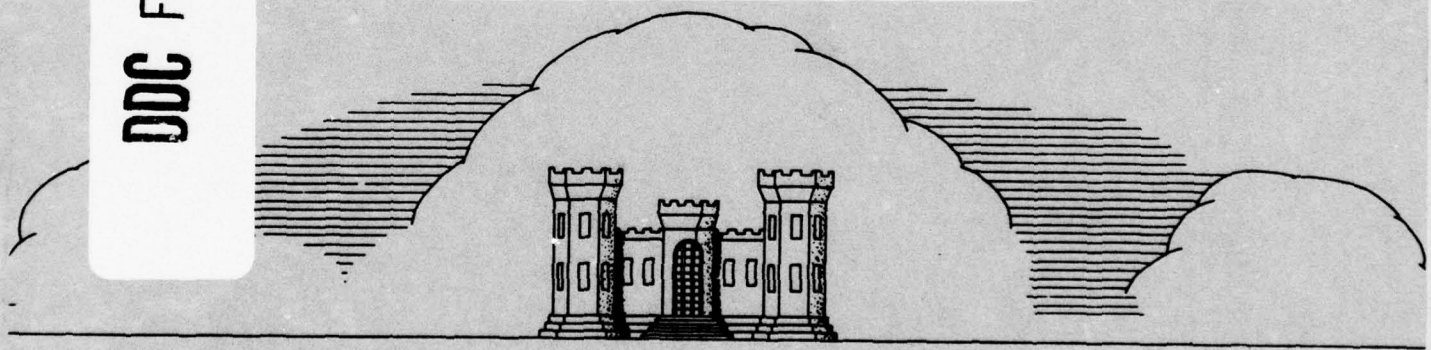
ADAMS COUNTY

INVENTORY NUMBER NDS PA-332

PHASE I INSPECTION REPORT

(6) NATIONAL DAM SAFETY PROGRAM.
Antietam Dam (NDS PA-332). Potomac River Basin, Adams County, Commonwealth of Pennsylvania. Phase I Inspection Report.

(15) DACW31-78-C-0044



Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland

by
BERGER ASSOCIATES, INC.
CONSULTING ENGINEERS
HARRISBURG, PA.

(12) 52p.

(11) SEPTEMBER 1978

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	ANTIETAM DAM
State & State No.	PENNSYLVANIA - 1-73
County Located:	ADAMS
Stream:	EAST BRANCH ANTIETAM CREEK, POTOMAC RIVER BASIN
Date of Inspection:	July 21, 1978

Based upon the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in good condition.

The spillway with storage has the capacity for passing 76 percent of the PMF and consequently is inadequate for passing the PMF without overtopping the dam. On the basis of this capacity, the spillway is considered inadequate but not seriously inadequate.

In order to maintain the dam in good condition and to provide for emergency conditions, the following recommendations are presented for action by the owner.

1. That the downstream slope cover be cut regularly to permit close observation of the slope surface.

2. That the groundhog hole observed on the downstream slope be repaired and that other such holes that may be discovered after cutting the slope cover be also repaired.

3. That a formal surveillance program and downstream warning system be developed to be used during periods of intense or prolonged rainfall or other emergency conditions.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: September 22, 1978

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
HENDRIK JONGSMA
ENGINEER

APPROVED BY:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

DATE: 26 Sep 78

November 13, 1973 In reply refer to
1-73

Mr. Richard A. Miller
Borough Manager
Borough of Waynesboro
57 East Main Street
Waynesboro, Pennsylvania 17268

Dear Mr. Miller:

Receipt is acknowledged of your letter dated November 7, 1973 in response to our earlier correspondence concerning the recent inspection of the Antietam Dam located in Hamiltonban Township, Adams County. WAYNESBORO RESERVOIR

Please be advised that we have reviewed your comments on the recommendations listed in the Inspection Report and consider them to be satisfactory with the exception of Item Number Four.

We consider the development and implementation of an effective warning system for this dam to be a high priority item. It is recommended that you get together with the Adams County Civil Defense organization and develop this plan as soon as possible.

Please provide this office with a schedule for the completion of this warning system by no later than December 1, 1973.

Your cooperation in this matter is appreciated.

Sincerely yours,

Joseph J. Ellam, Chief
Dam Safety Section
Division of Dam Safety & Waterworks

JJE/ns
cc: Col. Withers w/c of letter
C. H. McConnell
Paul Gardosik w/c of letter, Harrisburg, BWQM
Fred Marrocco, Harrisburg, BWQM
file
30-day

The Borough of Waynesboro
WAYNESBORO, PENNA. 17268

OFFICE OF BOROUGH MANAGER
57 EAST MAIN STREET

(717) 762-2101

NOV 9 1978

November 7, 1978

Commonwealth of Pennsylvania
Department of Environmental Resources
Post Office Box 2063
Harrisburg, Pennsylvania 17120

Re: Inspection-Antietam Dam
Waynesboro Borough Authority
Hamiltonban Twp., Adams Co.

Gentlemen:

Enclosed is the schedule of implementation of the recommendations of the recently prepared report on the subject impoundment. I trust this will meet with your approval.

Yours very truly,

Richard A. Miller
Borough Manager

RAM
lkh

WAYNESBORO BOROUGH AUTHORITY

ANTIETAM DAM

SCHEDULE OF IMPLEMENTATION

1. Fill groundhog hole and inspect slope November 1, 1978.

2. Control vegetation growth and examine down stream slope for signs of distress. Fill all holes - Each Spring.

3. Engineering inspection and evaluation of dam condition - Spring of each year.

4. Emergency warning system - Study and plan completed by September 1st, 1979.

OVERVIEW

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States. Phase I Inspection and Report is limited to a review of available data, a visual inspection of the dam site and the basic calculations to determine the hydraulic adequacy of the spillway.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Dam and Appurtenances

The dam is located on the East Branch of Antietam Creek about 1500 feet above the mouth of Hayes Run. The dam consists of an embankment 815 feet long including a 65 foot long spillway. The embankment is a zoned earthfill structure with a downstream slope of 2H to 1V and an upstream variable. Refer to Appendix D, Plate VII, for a typical section.

The appurtenant structures include spillway, spillway outlet channel and stilling basin and an intake structure. The spillway is a concrete ogee section 65 feet in length. A footbridge spans the spillway with a center pier resting directly on the spillway crest at its center. The spillway outlet channel is a sloping trapezoidal chute with concrete gravity walls and slabs. It terminates at the stilling basin some 300 feet downstream.

The intake structure houses three control valves and is 65 feet above the invert. A 60-inch diameter concrete pipe extends through the embankment. It is plugged at its upstream terminus with a 14-inch pipe extending through the plug into the reservoir. Two 10-inch intake pipes are located in the tower through which water can be taken from the reservoir at two different levels. The two 10-in pipes terminate, along with the 14-inch pipe at the bottom of the tower. All three discharge into the 60-inch pipe and are carried to the end of the 60-inch pipe at the downstream toe where the conduit is plugged and reduced to an 18-inch pipe. All flow passes through this 18-inch pipe and is discharged

to the natural stream at the stilling basin. The water for supply to Waynesboro is conveyed from a pumping station located about 1.75 miles downstream from the dam.

B.	Location:	Hamiltonban Township, Adams County U.S. Quadrangle, Iron Springs, Pa. Latitude 39°-49.1', Longitude 77°-27.2' (Appendix D, Plates I and II)
C.	Size Classification:	Intermediate (70 heet high)
D.	Hazard Classification:	High (Section 3.1.E)
E.	Ownership:	The Waynesboro Borough Authority 57 East Main Street Waynesboro, Pennsylvania 17268
F.	Purpose of Dam:	Water Supply

G. Design and Construction History

The dam was designed by Gannett, Fleming, Corddry and Carpenter, Harrisburg, Pennsylvania, for Waynesboro Borough Authority. Revisions to the design drawings were made on February 1, 1952. The revisions involved the elimination of a morning glory type drop structure and replacement with a 5 foot diameter concrete blowoff pipe. Numerous revisions were made during the construction period as a result of unexpected foundation conditions including the following:

1. Key wall on centerline eliminated from Station 1+90 to the west abutment.
2. Broken rock placed in downstream section of dam in lieu of semi-impervious material.
3. An 18-inch filter placed between the pervious material and the downstream rock.
4. Additional drilling and grouting at the abutments.
5. Gravity walls used instead of rock anchored walls (rock too broken).
6. Spillway slabs not doweled to rock, key walls were used.

The Commonwealth of Pennsylvania issued a permit for construction in February 1952. Construction was completed by February 1953. The Lycoming Construction Company, Inc. of Williamsport, Pennsylvania was the contractor.

H. Normal Operating Procedures

The dam is for domestic water supply for the Borough of Waynesboro, Pennsylvania. A water supply intake and pumping station is located

at Old Forge about 1.75 miles downstream from the dam. Releases are made through valves located in the control tower to satisfy the requirements downstream.

1.3 PERTINENT DATA

A.	Drainage Area (square miles)	
	Computed for this Report	3.89
	Design engineer used 3.94	
B.	Discharge at Dam Site (cubic feet per second) See Appendix B for calculations	
	Maximum known flood at dam site June 22, 1972 - Estimated	450
	Warm water outlet at pool elevation 1246	15
	Outlet tunnel at low pool elevation 1207	7
	Outlet tunnel at normal pool elevation 1258	35
	Spillway capacity at maximum pool elevation 1270 from design rating	9,750
C.	Elevation (feet above mean sea level)	
	Top of dam	1,270
	Normal pool	1,258
	Upstream portal invert of outlet conduit	1,205.5
	Downstream portal invert of outlet conduit, about	1,205
	Streambed at centerline of dam	1,201
	Maximum tailwater - Estimate	1,210
D.	Reservoir (miles)	
	Length of maximum pool	0.6
	Length of normal pool	0.5

E. Storage (acre-feet)

Spillway crest (Elev. 1,258) from designer's graph	464
Top of dam (Elev. 1,270) from Designer's graph	866

F. Reservoir Surface (acres)

Top of dam (Elev. 1,270) from designer's graph	40
Spillway crest (Elev. 1,258) from designer's graph	27

G. Dam

For general plan and typical sections refer to Appendix D, Plates V and VII.

The dam is a zoned earth embankment with a 2H to 1V slope ratio for the downstream slope. The upstream slope varies. Refer to Appendix D, Plate VII.

The central portion of the dam is composed of impervious fill with more pervious material and rock indicated on the upstream and downstream sides.

The top width of the dam is twenty feet and is covered with a stone surface.

The length of the dam including the spillway is 815 feet and it is 70 feet in height above the stream bottom.

A cutoff trench is provided and is filled with impervious earth. Drilling and pressure grouting was carried out in the underlying foundation rock formations. Refer to Appendix D, Plate VII.

H. Outlet Conduit

Type: 60-inch diameter concrete pipe under the embankment. A 14-inch diameter cast iron pipe upstream inside of the 60-inch pipe to the intake tower. Two additional intakes to intake tower at higher levels are 10-inch diameter cast iron pipes. An 18-inch pipe from downstream end of 60-inch pipe to the stilling basin.

Length: 270 feet of 60-inch concrete pipe and 115 feet of 18-inch cast iron pipe. Total length 385 feet.

Closure: 14-inch gate valve in intake tower.

Access: Intake tower is 35 feet upstream from centerline of dam and is connected to top of dam by means of a 28-foot long single-span bridge.

Regulating Facilities: 14-inch gate valve. There are also two higher level, 10-inch gate valves for admitting water at selected levels.

I. Spillway

Type: Uncontrolled standard ogee weir with straight concrete lined chute. Side walls lean slightly outward.

Length: 65 feet at crest and 67 feet at top of wide walls. A two-foot wide pier at center, supports a two-span foot bridge so net length is 63 feet at crest and 65 feet on top of wall.

Crest elevation: 1,258.

Upstream channel: Sweeping left turn about 150 feet long, 75 feet wide and 4 feet deep at normal pool level. Bottom consists of one-foot diameter stones.

Downstream channel: Ogee weir delivers water to straight, concrete-lined chute, 340 feet long. Chute narrows to 25-foot width near bottom, then widens to stilling pool measuring 40 feet by 55 feet long. Stilling pool has two rows of concrete baffles. The natural stream downstream from stilling pool is narrow and flows through a heavily wooded area.

J. Regulating Outlet

The regulating outlet consists of 6-foot by 6-foot intake tower from which water drains to the downstream end of the spillway chute through an 18-inch cast iron pipe. Water is admitted to the tower by means of the following pipes and valves:

Size	Invert Elevation
10 inch	1,245
10 inch	1,230
14 inch	1,205.5 (blowoff)

The bottom pipe was the bypass during construction and certain portions of it, which are under the embankment, consist of 60-inch diameter concrete pipe.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Data Available

1. Hydrology and Hydraulics

The hydrologic and hydraulic analyses available from PennDER were not very extensive. No frequency curve, unit hydrograph, design storm, design flood hydrograph, nor flood routings were available in the file.

The file did contain a spillway rating curve, an area-capacity curve and information that the spillway was designed to pass a flow of 9,150 cfs.

2. Embankment

The information available for the design of the embankment are contained in correspondence between PennDER and the design engineer and copies of a soils consultant report. The data are on microfiche files and were not reproduced for inclusion in this inspection report.

The data are quite comprehensive regarding the soil types used and their physical characteristics. The engineering parameters are identified and supported by laboratory tests. Flow nets are indicated as having been developed and slope stability analyses were made. The results of these studies demonstrated the suitability of the designed slopes and the dimensions of the drainage features.

3. Appurtenant Structures

There are no design data in the PennDER files relative to the spillway and the intake and outlet structures. Information is limited to the design plans.

B. Design Features

1. Embankment

The dam embankment is a zoned earthfill structure with a downstream slope of 2H to 1V and an upstream slope varying from 2H to 1V at the top portion, 2.5H to 1V in the central portion and 3H to 1V in the lower portion. Refer to Appendix D, Plate VII.

The central portion of the embankment is composed of selected impervious material and the upstream and downstream slopes of this internal section is 1H to 1V. Semi-pervious material is indicated on the upstream sections of the embankment, over which is a 12-inch thick layer of crushed stone as a blanket for riprap on the surface. The downstream section of the embankment is composed of semi-pervious soil from the top of the slope to about one-third to one-half the slope distance toward the toe. At this point there is a sand and gravel material acting as a transition zone to the rock section below. There is no transition between the impervious fill and the downstream rock section.

The top of the embankment is 20 feet in width surfaced with six inches of crushed stone (grass is growing through this surface).

The length of the dam including the spillway is 815 feet and the top of the embankment is 70 feet above the stream channel.

A cutoff trench is provided and is filled with impervious earth. Drilling and pressure grouting was carried out in the underlying foundation rock formations. Refer to Appendix D, Plate VII.

2. Appurtenant Structures

The appurtenant structures for this dam include the spillway, spillway outlet channel and stilling basin and the intake tower.

The spillway is a concrete ogee section with a crest elevation of 1258. Its length is 65 feet between its abutment walls. A concrete footbridge spans the spillway having a two foot pier at the center. This pier reduces the effective length of the spillway crest to 63 feet.

The spillway outlet channel is a trapezoidal chute with concrete slabs and walls. The chute is about 300 feet long and terminates at the stilling basin. This basin is also concrete and is at elevation 1188, some 70 feet below the spillway crest. Refer to Appendix D, Plate IV and VIII.

The intake tower is a vertical structure some 65 feet in height above the invert to the deck of the building. This structure houses three valves at different elevations. All intake ports deliver water to the inside of the intake chamber and are discharged through a 60-inch pipe which is reduced to an 18-inch pipe to the stilling basin. There is no outlet structure. All flow is controlled from the intake tower.

C. Design Data

1. Hydrology and Hydraulics

The design data in the PennDER files was limited to a spillway rating curve, an area-capacity curve and information that the spillway was designed to pass 9150 cfs.

2. Dam

The data relative to the design of the dam are extensive on the materials used. Engineering parameters are summarized and indications are that seepage and slope stability studies were made. Results are summarized.

3. Appurtenant Structures

The information relative to the design of the spillway, spillway outlet channel, stilling basin and the inlet structure are limited to the design drawings.

2.2 CONSTRUCTION

Periodic inspection reports of the activity during construction are in the PennDER files. The reports indicate no leakage conditions and that the project was completed by a good contractor. Several changes were made during the construction as a result of unforeseen subsurface conditions. Refer to Section 1.2.G of this report for additional information.

2.3 OPERATION

Formal operational records for this facility are not available in the files. The water from the reservoir is released to the stream where at a point of about 1.75 miles downstream, an intake facility at Old Forge conveys the water to Waynesboro.

2.4 EVALUATION

A. Availability

The design data available for this dam were located in the project files of PennDER.

B. Adequacy

1. Hydrology and Hydraulics

The information regarding hydrologic and hydraulic design is very limited. Refer to Section 2.A.1. The design plans together

with the results of the field inspections provide sufficient information to evaluate the discharge capacity of this facility.

2. Embankment

The design plans and the summary data contained in the PennDER files indicate the extent of engineering calculations and designed features. These data are suitable for judging the adequacy of the embankment. Refer to Section 2.1.A.2.

3. Appurtenant Structures

Design information is limited to the design drawings. These data, in addition to the observed conditions are suitable, for the purposes of this inspection, to assess the adequacy of these features.

C. Operating Records

There were no formal operating records in the PennDER files, nor from the owner. The water from this facility is released to the natural stream and is conveyed to an independent intake facility located about 1.75 miles downstream. The maximum drawdown during a dry summer was 12 feet according to the owner's representative. This was necessary in order to meet the water supply demand during this period.

D. Post Construction Changes

There is no information in the PennDER file nor offered by the owner to indicate any changes to this facility since the completion of construction in 1953.

E. Seismic Stability

The dam is located in Seismic Zone 1 and it is considered that the static stability with normal safety factors is sufficient to withstand minor earthquake induced dynamic forces. No calculations or studies have been made to confirm this.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The overall appearance of this facility is good. The downstream slope is heavily covered with weeds and brush. It was difficult to observe the condition on the slope surface. Access to the toe of the embankment was good and the downstream area below the toe is mowed and well maintained. Other features of the project including the spillway, intake structure and spillway outlet channel with stilling basin are all in apparent good condition.

B. Dam

The embankment structure is in good condition. There were no signs of any physical distress. The embankment crest appeared level with good horizontal alignment. The upstream slope of dumped rock is reasonably uniform with some weeds and brush growing through the rock. Refer to Appendix D, Plate III. The downstream slope is heavily covered with weeds and brush making it difficult to observe the surface condition. Inspection along this area and at the toe of the slope did not find any seepage or wet conditions. At least one groundhog hole was observed and it is assumed that others are in the underbrush at other locations. The area beyond the toe is also dry and does not show signs of distress.

The abutments with the natural ground at the left and the spillway and spillway outlet channel at the right are sound. Seepage was not detected in these areas. The embankment appears to be in good condition.

C. Appurtenant Structures

The spillway, which is an uncontrolled concrete ogee section shows some slight weathering on the surface as a result of the flow of water. The abutments appear to be in good condition although there are some very fine cracks in the walls with calcite stains. The concrete slabs in the spillway outlet channel and the walls along this descending chute are in good condition. Refer to Appendix D, Plate IV. The footbridge across the spillway is also in good condition as is the stilling basin.

The intake tower is a concrete structure which houses three valves (two 10-inch and one 14-inch) at different elevations. The structure and its access bridge from the embankment are in good condition. Refer to Appendix D, Plate III. The gates in the tower were

operated at the time of this inspection and were demonstrated to work satisfactorily. These controls are suitable for drawdown of the reservoir in the event of an emergency. Refer to Appendix D, Plate VI.

D. Reservoir Area

The entire area surrounding the reservoir area is forested with mature trees and woodland. There is no evidence of sedimentation problems and none reported by the owner. The approach to the spillway is clear and is directly from the reservoir area. Refer to Appendix D, Plate III.

E. Downstream Channel

The downstream channel, below the stilling basin is a typical mountain stream. The overbank areas are wooded to the edge of the channel. The channel itself is mostly gravel and various sized cobbles. The intake for the water supply to the Borough of Waynesboro is located about 1.75 miles downstream.

There is no significant population downstream of the dam that would be endangered. The major structure is the intake pumping station located at Old Forge adjacent to the stream. There is also a summer camp with four barracks buildings in a low-lying area near Antietam Creek about 3 miles downstream. Danger to life for this dam could be more than a few when the camp is occupied; therefore, the hazard classification is "High".

3.2 EVALUATION

On the basis of the information contained in the PennDER files, discussion with the owner's representative and the visual inspection, this dam is judged to be in good condition.

The groundhog hole observed in the downstream slope should be repaired as well as others that may be discovered. Inspection and repair to these holes in the spring when the cover is burned and cut would be advisable.

Seepage conditions were neither observed nor reported by the owner's representative, indicating that the seepage control of the dam is operating properly.

The maintenance of the intake control valves is good as demonstrated by the operation of these controls at the time of the inspection. According to the owner's representative bi-monthly operation of the valves and inspection of the entire tower is made.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURE

The reservoir is used as a water supply source for the Borough of Waynesboro, Pennsylvania. The water from the reservoir is released through one of three valves, located in the intake structure, through an underground conduit which discharges directly into the stilling basin. These valves are used for control when the normal flow over the spillway is not enough to satisfy the demands at the water supply plant just 1.75 miles downstream from the dam. The valve locations are: one 10-inch at elevation 1245, one 10-inch at elevation 1230, and one 14-inch at elevation 1205.5.

4.2 MAINTENANCE OF DAM

The maintenance of the dam is limited to the control of growth on the upstream and downstream slopes. The weeds are burned off the slope each spring and some cutting is done at this time.

4.3 MAINTENANCE OF OPERATING FACILITIES

The operating facility maintenance involves the care of the inlet valves and their controls and keeping the spillway and spillway channel clear. According to the owner's representative, the valves are operated about once every two months. At the same time the entire tower is inspected from top to bottom.

4.4 WARNING SYSTEM

There is no formal warning system in effect.

4.5 EVALUATION

The operational procedures for this facility are satisfactory. The maintenance of the dam should continue the cutting of the downstream growth each spring to permit detection of the groundhog hole locations and these holes should be repaired when discovered.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analyses available from PennDER for Antietam Dam were not very extensive. No frequency curve, unit hydrograph, design storm, design flood hydrograph, nor flood routings were available in the file.

The file did contain a spillway rating curve, an area-capacity curve, and the information that the spillway was designed to pass a flow of 9,150 cfs.

B. Experience Data

No local information on hydrology is available. Records for nearby USGS gaging stations at Needmore and Fayetteville, Pennsylvania, indicate that the maximum flood at this site probably occurred on June 22, 1972, and that the peak discharge was about 450 cfs.

Personnel at the Baltimore District of the Corps of Engineers have recommended that their PMF relation curve for the Potomac River basin be used for calculating the spillway adequacy.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event, until the dam is overtopped.

D. Overtopping Potential

Comparison of the estimated PMF peak inflow of 14,400 cfs, with the estimated ultimate spillway capacity of 9,750 cfs, indicates that the capacity is only 68 percent of the PMF peak flow and that the potential for overtopping of Antietam Dam exists.

An estimate of the storage effect of the reservoir shows Antietam Dam Reservoir does not have the storage available that is necessary to pass the PMF without overtopping (See Appendix B). It does have the capacity to pass 76 percent of the PMF with the available storage.

E. Spillway Adequacy

This dam has a size classification of "Intermediate" (70 feet high and 866 acre-feet of storage) and a hazard potential classification of "High" (Waynesboro pumping station and water treatment plant and a religious summer camp with four barracks buildings are in a low area near Antietam Creek about three miles downstream). These two classifications indicate a recommended spillway design flood (SDF) equal to the Probable Maximum Flood (PMF).

On the basis of the Corps of Engineers' criteria and guidelines, and the following information; the spillway for this dam is considered to be inadequate, but not seriously inadequate.

1. The dam has a "High" hazard potential (See Section 3.1.E).

2. The combined effect of spillway capacity and the reservoir storage is sufficient to pass 76% of the PMF without overtopping the dam. Refer to Sheet 4 of Appendix B (criteria requires a full PMF).

3. Since this dam is an earthfill structure, failure of the dam is expected if the dam is overtopped.

4. In the event of dam failure, it is expected that the surge of suddenly released water will increase the loss-of-life hazard downstream over that anticipated just prior to failure.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

There were no visual observations of undue embankment settlement or sloughage. Seepage was also not evident on the downstream slope, along its toe or at the abutments.

2. Appurtenant Structures

The visual inspection did not find any major signs of distress on the spillway, spillway outlet channel, stilling basin or intake structure.

B. Design and Construction Data

1. Embankment

The design reports in the PennDER files indicate that the embankment design was based upon the engineering properties of the soils used in its construction and that slope stability calculations were made. Also that seepage studies were carried out as indicated by the development of flow nets.

The design drawings show the physical features of the embankment and indicate that proper steps to control seepage were taken with the use of a cutoff trench, grouting of the foundation and the use of semi-pervious materials on the downstream slope. A toe drain is shown on the drawings with an outlet at the end of the stilling basin. Although there is no filter between the impervious core and the downstream rock section, no evidence of seepage or piping was noticed.

This information, together with the PennDER construction inspection reports of good construction practice and the observations made during this inspection indicate that the stability of the embankment is satisfactory.

2. Appurtenant Structures

The ogee section appears to be stable and well founded on firm base. The underlying rock is dense and is not susceptible to large scale seepage. The drawings in the PennDER files indicate a stable

section, although there are no design calculations to support this or any of the other appurtenant structures.

The spillway outlet channel and the stilling basin are also judged to be stable on the basis of the available details shown on the plans.

The intake tower and the outlet conduit appear to be properly designed for the expected loadings.

C. Operating Records

The information obtained from the owner indicates no formal records of the operation of the dam are kept.

D. Post Construction Changes

There have been no modifications to the dam since the completion of its construction in 1953.

E. Seismic Stability

This dam is located in Seismic Zone 1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

A. Safety

The visual inspection and the review of the available plans and records for this facility indicate that the dam is in good condition. Observations during the inspection did not find any signs of structural distress on the embankment or in any of the appurtenant structures.

The only concern as a result of this inspection is the density of the growth on the downstream slope, and the presence of at least one groundhog hole in this slope. The slope cover should continue to be cut each spring to permit the close inspection for other such holes and all holes should be repaired and sealed.

The results of the hydrologic and hydraulic evaluation indicate that the spillway does not have the capacity to pass the PMF without overtopping the dam and is, therefore, inadequate. It will, however, with available storage pass 76 percent of the PMF and on the basis of this, the capacity is not considered to be seriously inadequate.

B. Adequacy Of Information

The information available in the files is considered to be adequate for assessing the condition of this facility within the scope of the Phase I inspection.

C. Urgency

The condition of the dam is considered to be good. The maintenance of the slope condition is not considered urgent, but should continue to be carried out on a regularly scheduled basis. The existing holes in the downstream slope should be repaired as soon as possible.

D. Necessity for Additional Recommendations

Additional studies are not indicated at this time. Attention should be given to the recommendations presented below.

7.2 RECOMMENDATIONS

A. Facilities

The observed condition of these facilities is good and there is no need for any action at this time. The attention to the downstream slope involves maintenance and operations.

B. Operating and Maintenance Procedures

It is recommended that the downstream slope continue to be cut to permit the detection of groundhog holes or other signs of distress and that all such holes be filled and the slope dressed to the natural slope surface.

Additionally, a formal downstream warning system should be developed along with a formal surveillance procedure to be used during periods of intense or prolonged rainfall.

APPENDIX A

VISUAL INSPECTION

CHECK LIST - DAM INSPECTION PROGRAM

PHASE I - VISUAL INSPECTION REPORT

NAD NO. 332

PA. ID # 1-73 NAME OF DAM Antietam Impounding HAZARD CATEGORY High

TYPE OF DAM: Earthfill

LOCATION: Hamiltonban TOWNSHIP Adams COUNTY, PENNSYLVANIA

INSPECTION DATE 7/21/78 WEATHER Sunny - Hot TEMPERATURE 80 - 90

INSPECTORS: H. Jongsma, R. Houseal — PennDER
R. Steacy, A. Bartlett — Walter Leidig
Paul Cordsik
Owner's Representative
Allan Benshoff

NORMAL POOL ELEVATION: 1258 AT TIME OF INSPECTION:

BREAST ELEVATION: 1270 POOL ELEVATION: 1258

SPILLWAY ELEVATION: 1258 TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: (1972) 1259.25

GENERAL COMMENTS:

The outward appearance of this facility is good.

Valves in the gate house are operated on the average of once every two months. The entire intake tower is inspected at the same time from top to bottom.

The owner's representative indicated that someone is at the dam each day.

The maximum known drawdown was 12 feet during a very dry period.

The maximum recalled water level over the spillway was 15 inches during the 1972 tropical storm Agnes.

DAM NO. NAD 332

VISUAL INSPECTION

EMBANKMENT	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SURFACE CRACKS	None	
B. UNUSUAL MOVEMENT BEYOND TOE	None	
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	Groundhog hole in D/S slope 300'± from left abutment - about 75' down slope. As near as can be determined, the D/S is uniform.	
D. VERTICAL & HORIZONTAL ALIGNMENT OF CREST	Horizontal and vertical both good.	
E. RIPRAP FAILURES	None	
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Good	
G. SEEPAGE	None observed along toe or other areas. Slope could not be observed clearly but toe is entirely dry as was the area beyond toe.	
H. DRAINS	Toe drain indicated on plans.	
J. GAGES & RECORDER	None	
K. COVER(GROWTH)	Top grass mowed close over stone surface. Downstream heavily covered with weeds and brush - difficult to observe surface. Upstream - dumped rock up to 24 inch size, occasional weeds and brush on slope.	

DAM NO. NAD 332

VISUAL INSPECTION

OUTLET WORKS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. INTAKE STRUCTURE	Concrete tower with 3 valves for intake control. Valves operated.	
B. OUTLET STRUCTURE	None - outlet to stilling basin.	
C. OUTLET CHANNEL	Natural stream below stilling basin	
D. GATES	Three valves at different elevations to stilling basin. Valves operated for this inspection. Outlet at stilling basin.	
E. EMERGENCY GATE	Same as above.	
F. OPERATION & CONTROL	Intake is discharged directly to stilling basin. Control by one of three valves: Two 10-inch and one 14-inch.	
G. BRIDGE (ACCESS)	Footbridge - concrete.	

DAM NO. NAD 332

VISUAL INSPECTION

SPILLWAY	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. APPROACH CHANNEL	Curved concrete walls - good condition - earth and stone bottom (3' - 4' deep).	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Concrete ogee section. Slightly weathered from overflow. Abutments good. Slight cracks in spillway wall - calcite stains.	
C. DISCHARGE CHANNEL Lining Cracks Stilling Basin	Concrete slabs - flowing over full width from weir. Sloped concrete side walls to stilling basin - good condition.	
D. BRIDGE & PIERS	Footbridge (concrete) with center pier on spillway	
E. GATES & OPERATION EQUIPMENT	None	
F. CONTROL & HISTORY	No control.	

DAM NO. NAD 332

VISUAL INSPECTION

MISCELLANEOUS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
INSTRUMENTATION		
Monumentation	None	
Observation Wells	None	
Weirs	None	
Piezometers	None	
Other	None	
RESERVOIR		
Slopes	Forested	
Sedimentation	None reported	
DOWNSTREAM CHANNEL		
Condition	Mountain stream	
Slopes	Forest to water's edge.	
Approximate Population	More than a few.	
No. Homes	Pumping station 1.75 miles downstream. Summer camp - four barracks - 3 miles downstream.	

APPENDIX B

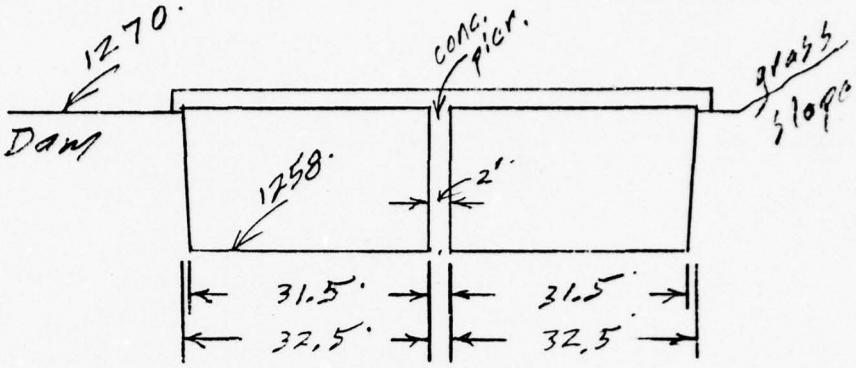
HYDROLOGY/HYDRAULICS

PROJECT _____ SHEET NO. 1

SUBJECT Waynesboro Dam ED No. 372

COMPUTED BY RES DATE 8-2-78 CHECKED BY JJPL 8-7-78

Spillway Rating



Elev. 1270

$Q = CLH^{3/2}$

$H = 12'$

$L = 32'$

$C = 4.0$

$Q = 4 \times 32 \times (12)^{3/2}$

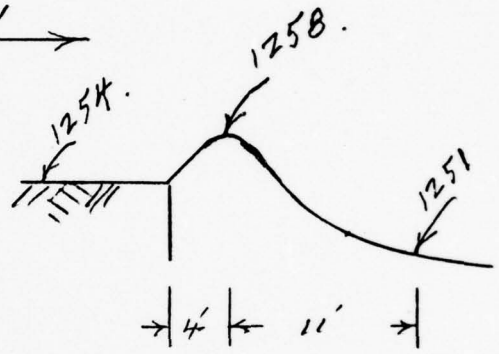
$= 5321$ cfs each opening.

2 openings $= 10,600$ cfs.

Designer's rating curve gives 9,750 cfs

Use designer's rating.

Flow →



Use "C" = 3.8 at H = 8'
4.0 at H = 12'
Ref Brater + King Fig. 5-26

Maximum Known Flood

No local information available
Est. Max flood that of June 22, 1972
Nearby USGS gaging stations:

Sta.	Drainage Area (sq mi)	Discharge (cfs)
Needmore	10.7	1,300
Fayetteville	5.05	392

Drainage area at dam 3.89 sq. mi.

$\left(\frac{3.89}{10.7}\right)^{.8} \times 1,300 = 578$ cfs $\left(\frac{3.89}{5.05}\right)^{.8} \times 392 = 318$ cfs

$\frac{578 + 318}{2} = 450$ cfs

PROJECT _____ SHEET NO. 2 OF

SUBJECT Waynesboro Dam I.D. No. 3??

COMPUTED BY RES DATE 8-4-78 CHECKED BY JJP 8-7-78

Warm water outlet

Highest intake is 10' C.I. pipe with invert at 1245. Use pool Elev. 1246.

compute as orifice $Q = Ca\sqrt{2gh}$.

End of 14" outlet pipe at estimated Elev. 1205 for £:

$h = 1246 - 1205 = 41'$

$Q = 0.6 \times 0.545 \times (64.3 \times 41)^{1/2}$

$= 16.8$ cfs.

Use 15 cfs.

$C = 0.6$.

$a = \pi R^2$.

$= \pi (0.417)^2$

$= 0.545$ ft^2.

Outlet at low pool

Lowest outlet is 14" pipe with invert at Elev. 1205.5. Use pool at 1207.

$h = 1207 - 1205 = 2'$

$Q = Ca\sqrt{2gh}$.

$= 0.6 \times 1.069 \times (64.3 \times 2)^{1/2}$

$= 7.27$ cfs.

Use 7 cfs.

$C = 0.6$.

$a = \pi R^2$

$= \pi (0.583)^2$.

$= 1.069$ ft^2.

Outlet at Normal pool (1258).

$h = 1258 - 1205 = 53'$.

$Q = Ca\sqrt{2gh} = 0.6 \times 1.069 \times (64.3 \times 53)^{1/2}$

$= 37.4$ cfs.

Consider 18" pipe, $L = 85'$ (toe of dam to outlet)

$Q = \frac{0.463}{n} \times d^{8/3} S^{1/2}$.

$= \frac{0.463}{0.015} \times (1.5)^{8/3} \times (0.624)^{1/2}$

$= 30.87 \times 2.949 \times 0.790$.

$= 71.9$ cfs.

Use 35 cfs.

$n = 0.015$.

$d = 1.5$.

$S = \frac{h}{L} = \frac{53}{85}$.

$= 0.624$.

SUBJECT Waynesboro Dam ID No. 332

COMPUTED BY RES DATE 8-4-78 CHECKED BY JP 8-7-78

Probable Maximum Flood

Baltimore Dist. C. of E. recommends that their PMF relation curve for Potomac River basin be used for this site.

Drainage Area = 3.89 square miles.

PMF from relation curve
= 3,700 cfs/sq mi.

3.89 × 3,700 = 14,400 cfs.

1/2 PMF = 7,200 cfs.

Storage Effect

PMF

$$\frac{\text{Maximum Spillway Discharge}}{\text{Peak Inflow}} = \frac{9750}{14,400} = 0.68$$

$$\frac{\text{Req. Resv. Storage}}{\text{Vol. of Inflow}} = 0.32$$

From Balt. Dist. C. of E. short cut routing method.

Vol. of inflow = 26" runoff.

= 26 × 3.89 × 53.33 = 5,394 acre feet.

Req. Resv. storage = 0.32 × 5,394 = 1,730 ac. ft.

Available storage = 866 − 464 = 402 ac. ft.

Waynesboro Dam will be overtopped by PMF.

1/2 PMF

$$\frac{\text{Maximum Spillway discharge}}{\text{Peak inflow}} = \frac{9,750}{7,200} = 1.35$$

Waynesboro Dam can pass 1/2 PMF peak flow without need for storage.

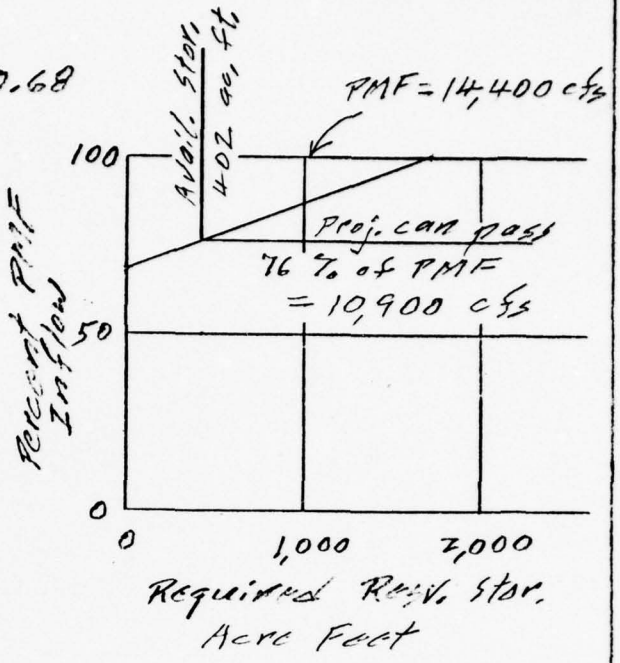
PROJECT Dam Investigation SHEET NO. 4 OF

SUBJECT Waynesboro Dam ID No. 332

COMPUTED BY RES DATE 8-18-78 CHECKED BY DJB

Spillway Adequacy

$$\frac{\text{Max Spillway Q}}{\text{PMF Peak Inflow}} = \frac{9750}{14,400} = 0.68$$



APPENDIX C

GEOLOGIC REPORT

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Names: Montalto Quartzite Member, Harpers Formation and Red Rhyolite Member, Catoctin Formation.

Lithologies: The Montalto is a medium gray colored, fairly thick bedded quartzite that weathers grayish yellow to brownish orange. There are minor interbeds of gray phyllite. The red rhyolite phase of the Catoctin Formation is a metamorphosed lava. The rock consists of a very fine grained ground mass with scattered visible grains of quartz and feldspar. Quartz and feldspar are also the principal minerals of the groundmass.

Structure

The valley of Antietam Creek is near the axis of an overturned syncline. There is also a normal fault, dipping steeply to the southwest that parallels the creek valley. The fault is the contact between the Montalto Quartzite and the Catoctin Rhyolite (Reference 1). Beds in the Montalto Member, on the southwest side of the fault strike about N25°E, and the layering in the rhyolite strikes about N20°E. Fracture traces strike N30° to 40°W and N85°W.

Overburden

The thickness of overburden indicated by the core borings and test pits was generally less than ten feet, but locally was 20 to 40 feet. The overburden consisted chiefly of brown and gray sandy clay and sandstone boulders over the Montalto Member, and gray clay with rhyolite boulders over the Catoctin Formation.

Aquifer Characteristics

Both the Montalto Member and the Catoctin Formation are composed of essentially impermeable rocks of very low porosity. Ground water movement is primarily along bedding planes and fractures, particularly along fracture trace zones. Both units are composed of essentially insoluble minerals and no secondary enlargement of permeable zones is to be expected.

Discussion

The dam was constructed with a cutoff trench dug 2 feet 6 inches into the rock. While there might be some ground water seepage along fractures associated with the fault, and along bedding planes, the generally poor permeability of the bedrock in this area is such that large scale seepage is unlikely. The rock is sound and firm, an excellent foundation material.

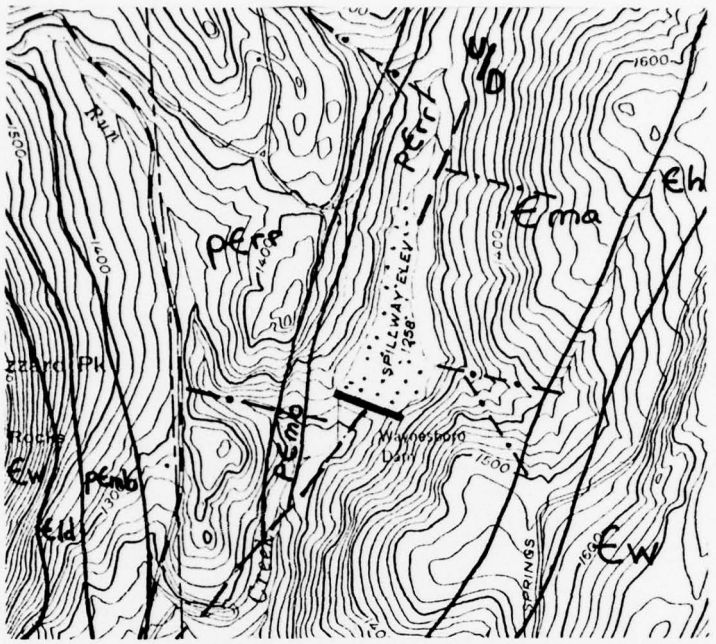
Sources of Information

1. Fauth, J.L. (1978) "Geological Map of the Iron Springs Quadrangle" Pa. Geological Survey, Atlas, A129C., Plate 1.

2. Core boring logs in file.

3. Air photographs, scale 1:24,000 dated, 1968.

GEOLOGIC MAP - WAYNESBORO D.E.



(Geology from Pa. Geol. Surv. Atlas 129C)

KEY

Ch	Harpers Fm.	Cld	Loudoun Fm.
Cma	Harpers Fm. - Montalto Member	pCmb	metabasalt
Cw	Weverton Fm.	pErr	red rhyolite
----	fault	-·-·-	air photo fracture trace

SCALE 1:24000

1 0 1 MILE

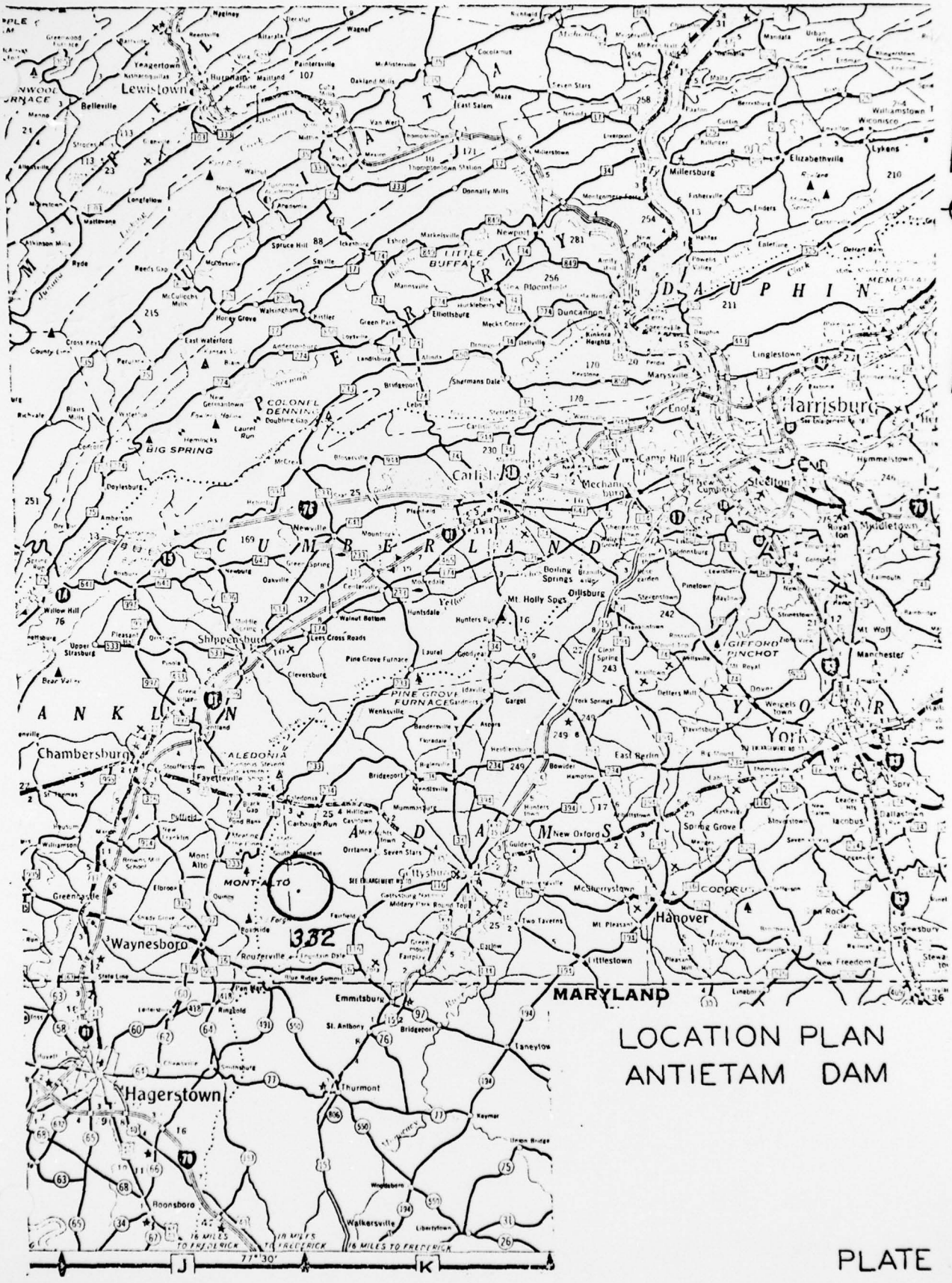
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

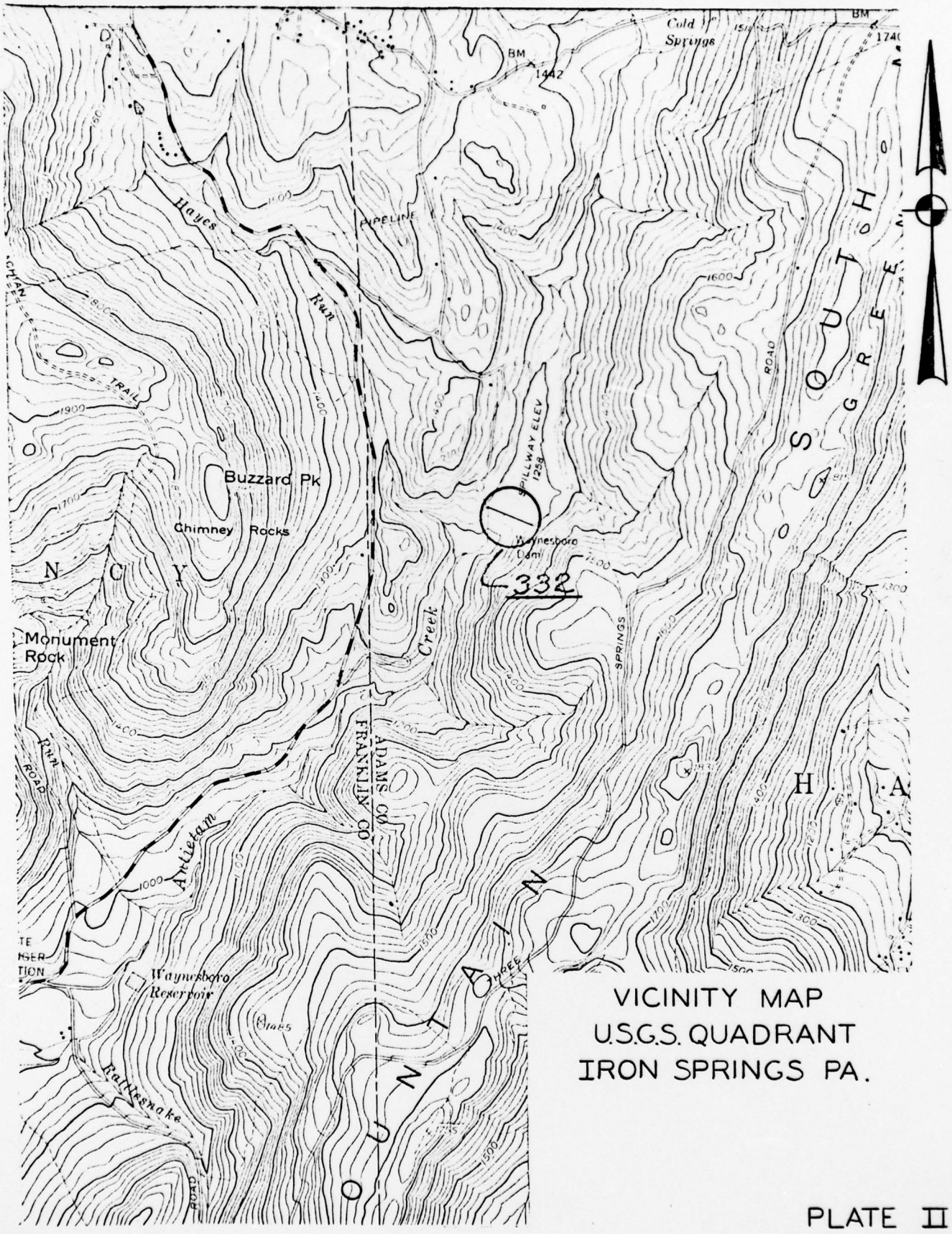
APPENDIX D

LOCATION, PHOTOGRAPHS & DESIGN DRAWINGS



LOCATION PLAN
ANTIETAM DAM

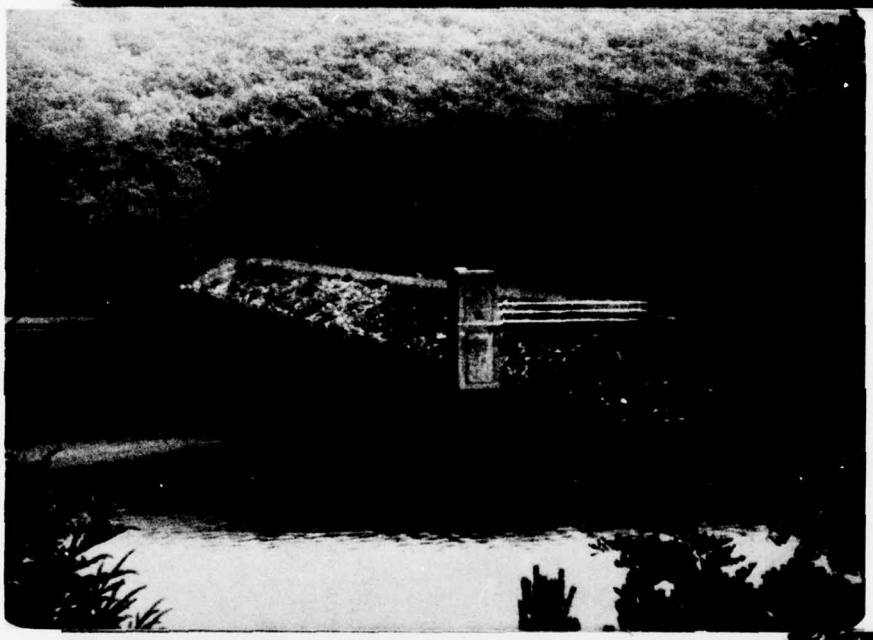
PLATE I



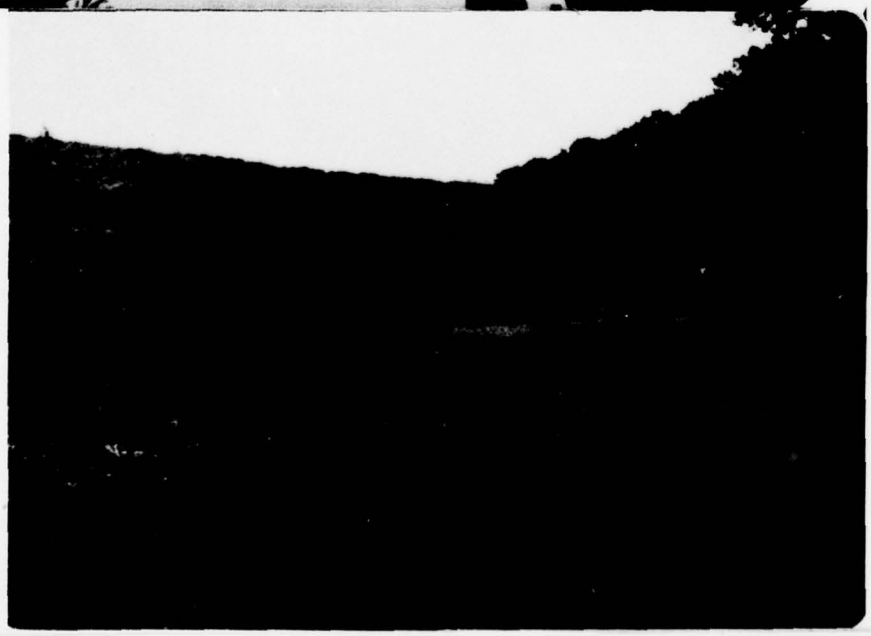
VICINITY MAP
U.S.G.S. QUADRANT
IRON SPRINGS PA.

PLATE II

Reservoir

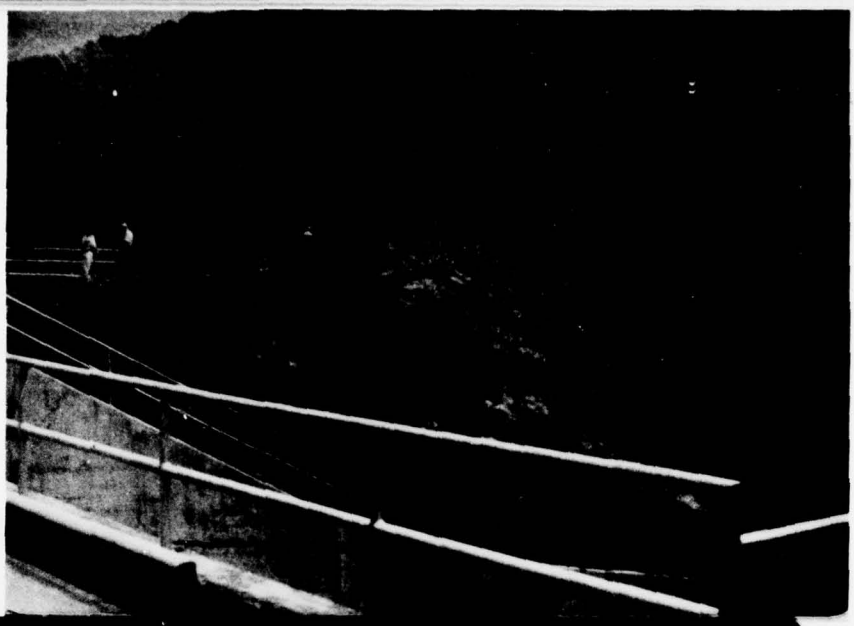


Upstream Slope
& Intake Tower

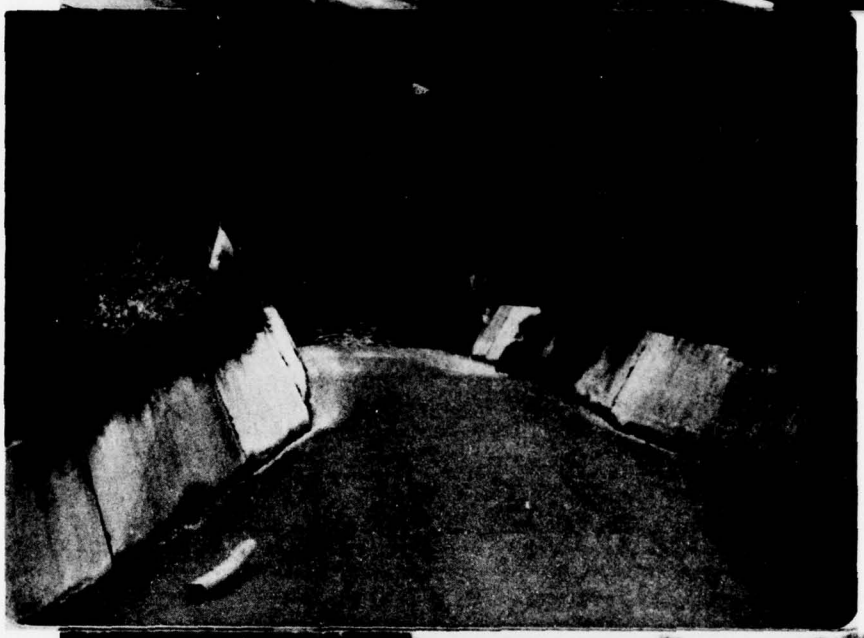


Downstream Slope

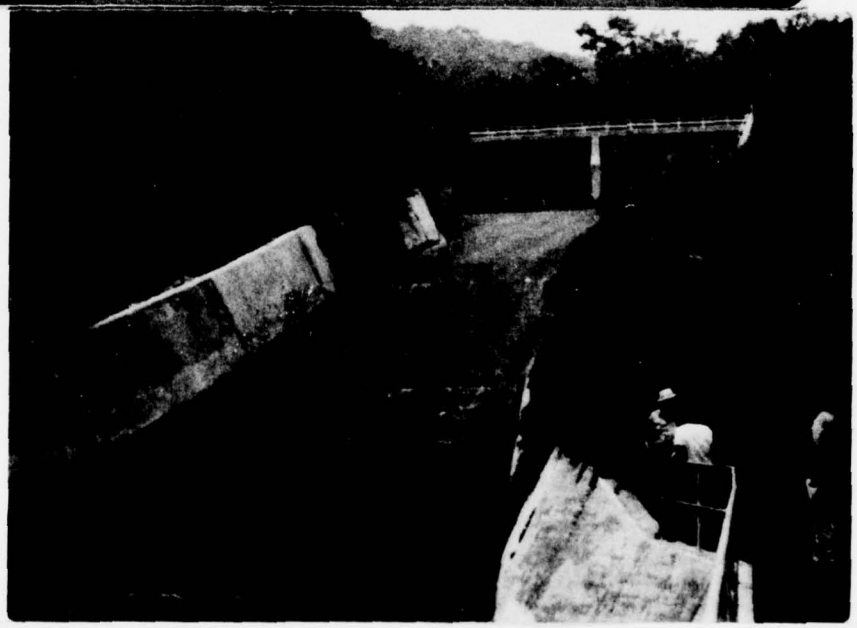
PLATE III



Downstream Slope
Standing On Bridge

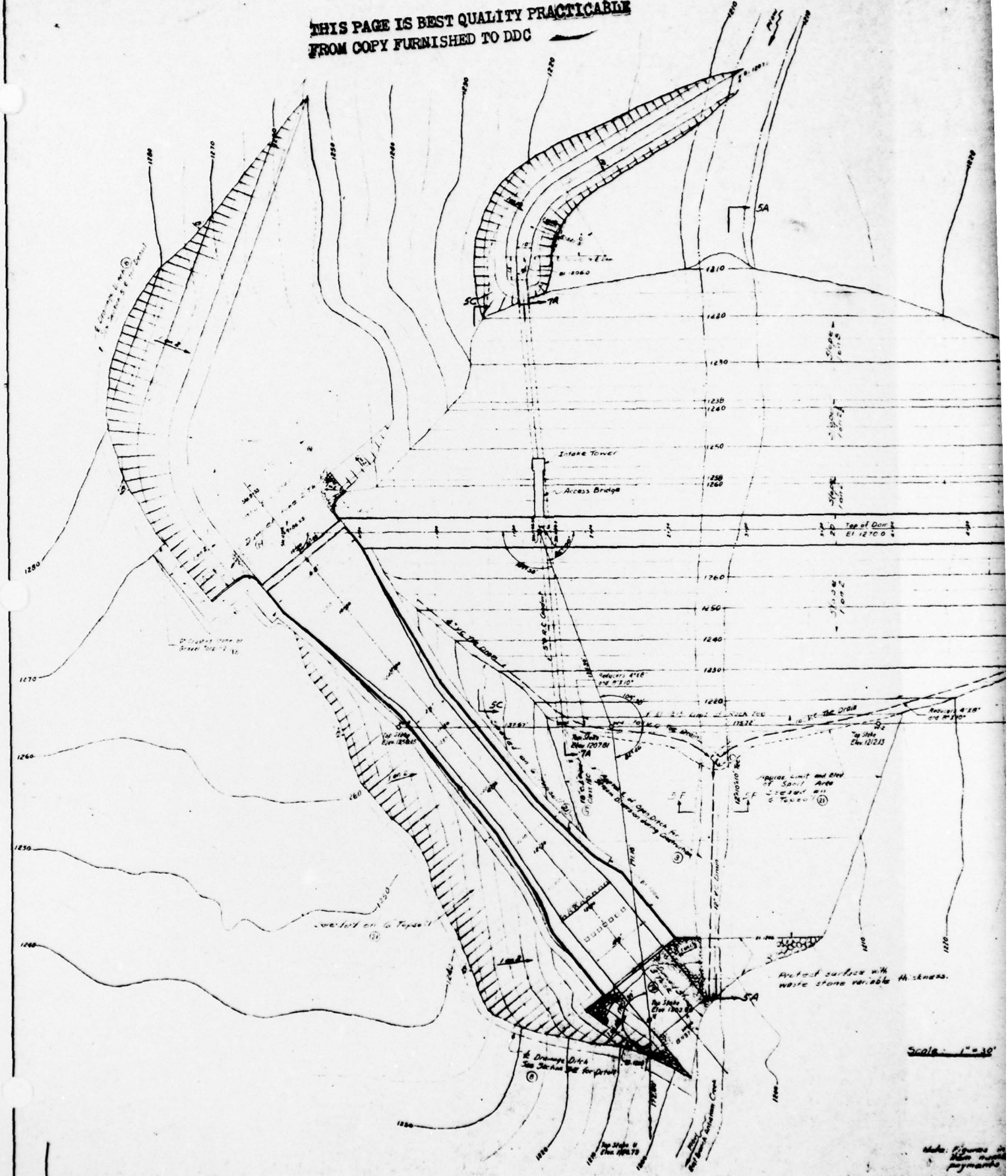


Spillway Chute



Spillway Chute
And Bridge

PLATE IV



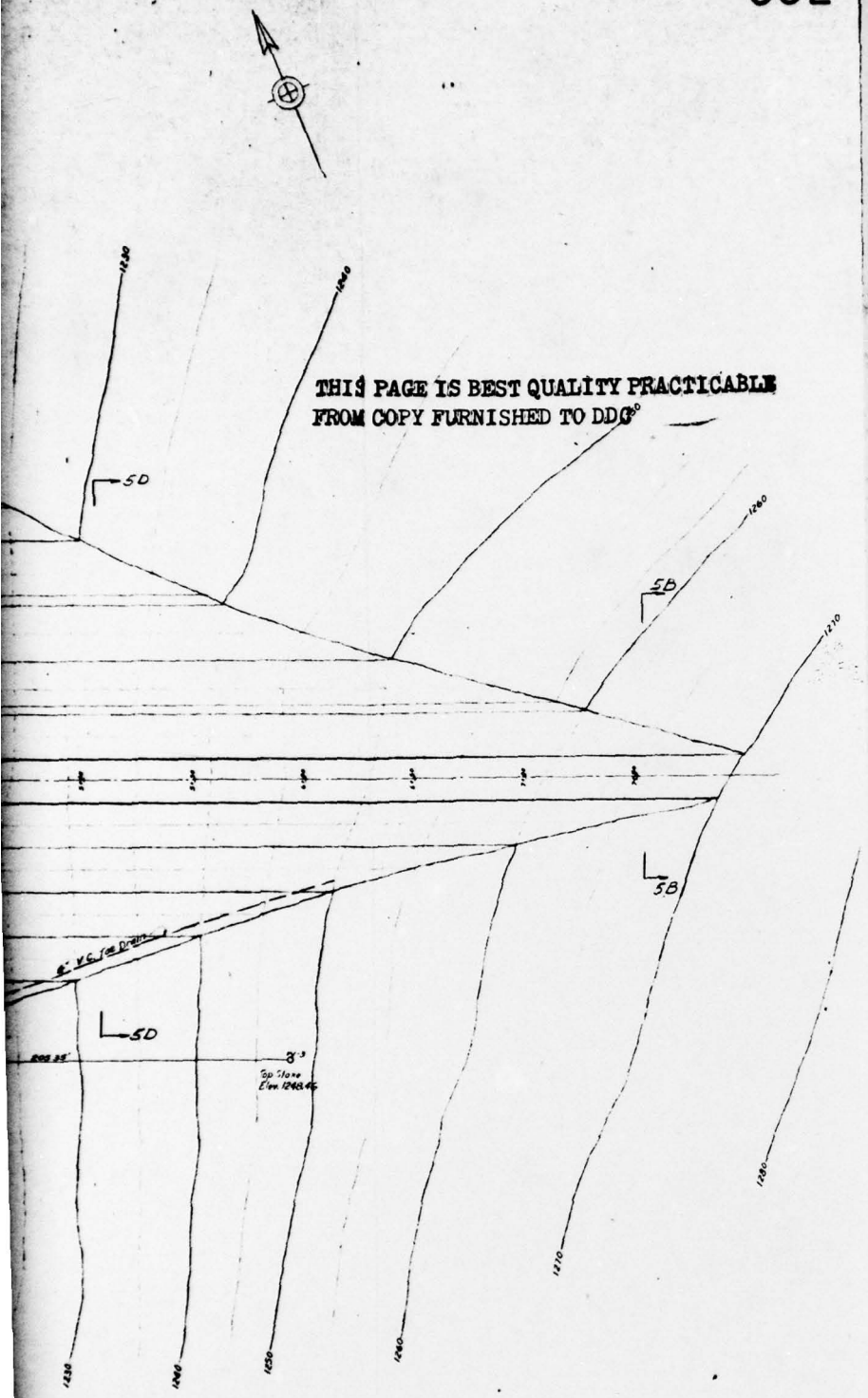


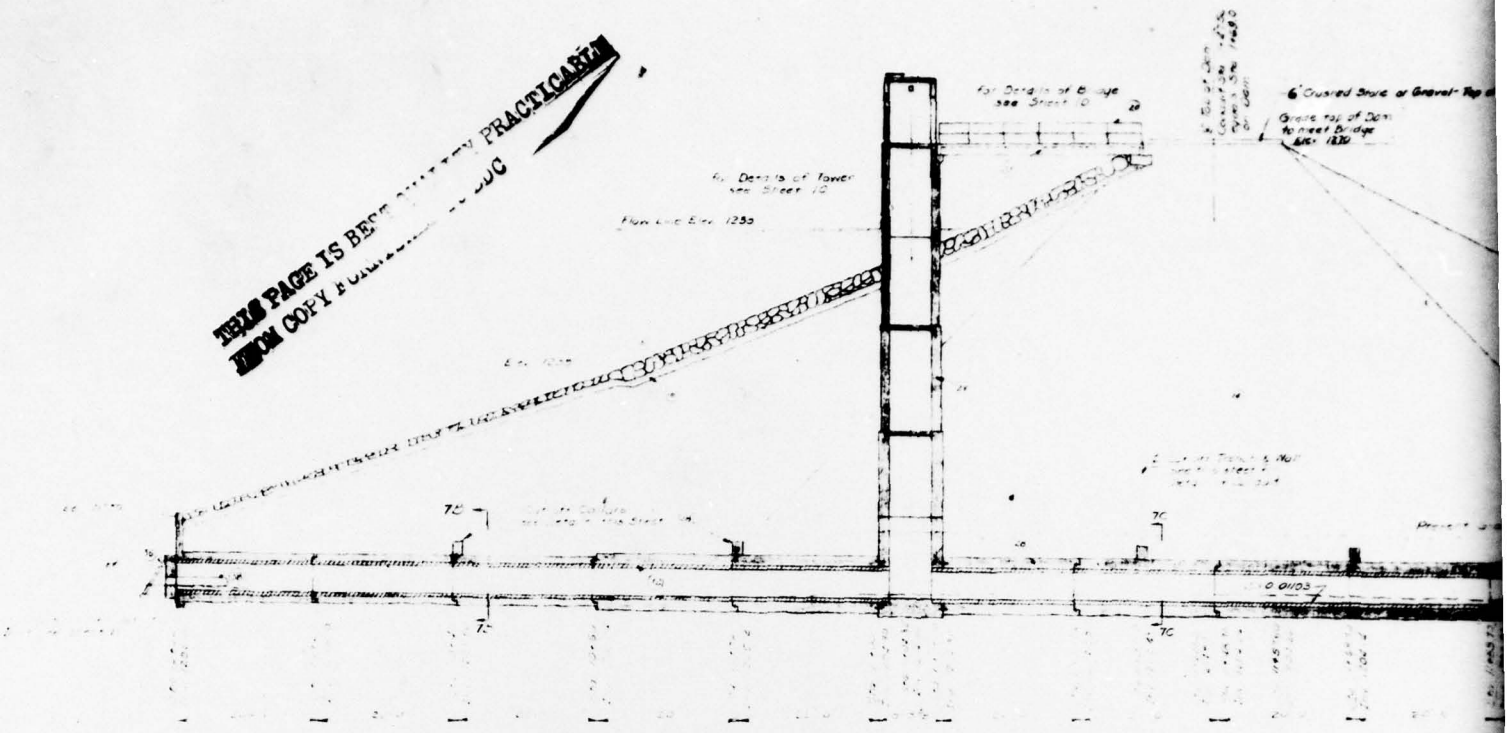
PLATE V

DRAWN C.Y.L.	WAYNESBORO BOROUGH AUTHORITY	SHEET No. 4 OF 12
TRACED C.Y.L.	WAYNESBORO PA.	
CHECKED L.A.G.	ANTIETAM DAM	JOB No. 1894
APPROVED	GENERAL PLAN	DATE Dec. 1961
APPROVED J.D.C.		

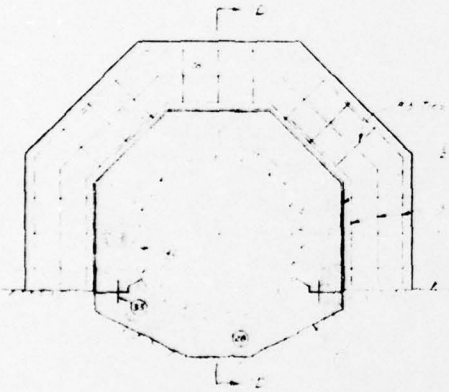
GANNETT FLEMING CORDDRY & CARPENTER, INC.
ENGINEERS
608 N. SECOND ST. HARRISBURG, PENNA.

REVISIONS			
No.	DESCRIPTION	DATE	BY

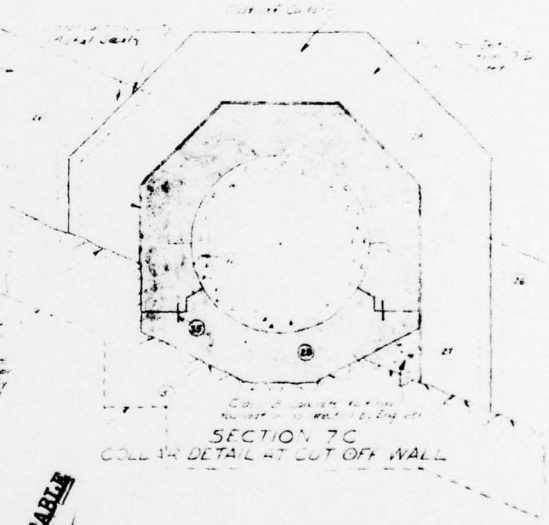
Shading indicates [illegible] under which [illegible] to exist.



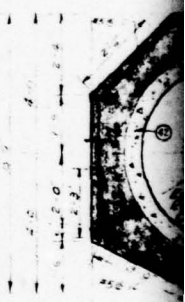
SECTION 7A



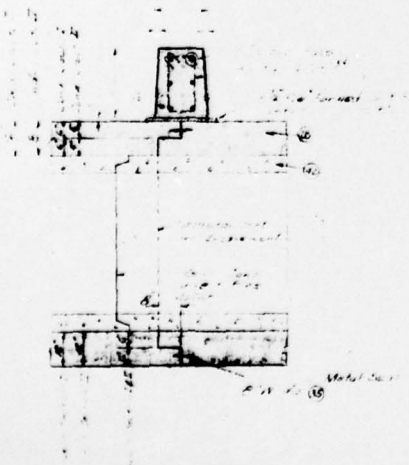
SECTION 7B
COLLAR DETAIL



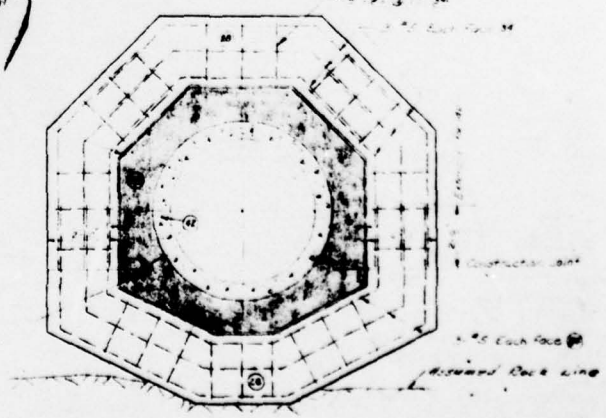
SECTION 7C
COLLAR DETAIL AT CUT OFF WALL



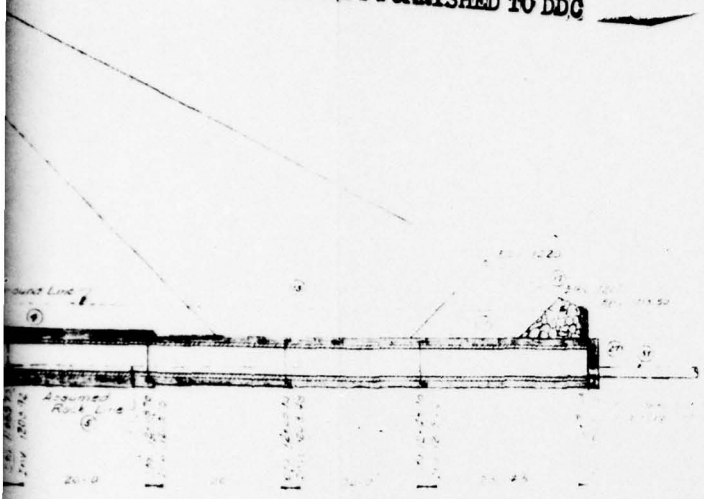
TYP. COLL. C
Sta. 10+50 to 11+80

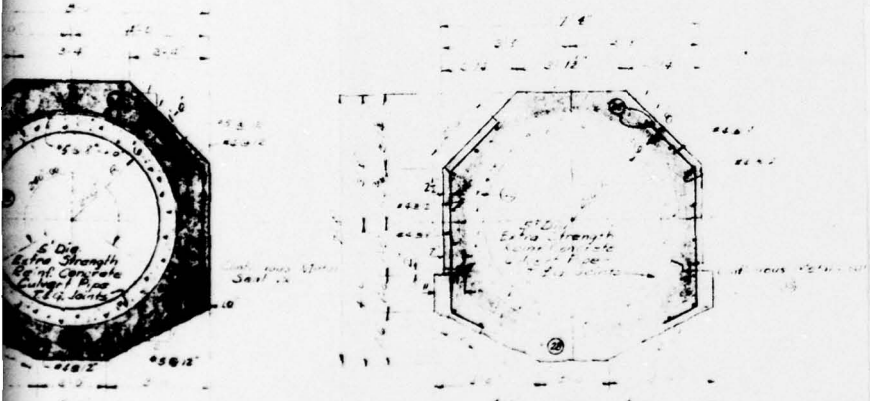


SECTION 7D
COLLAR DETAIL



FULL COLLAR DETAIL





CONDUIT SECTION I

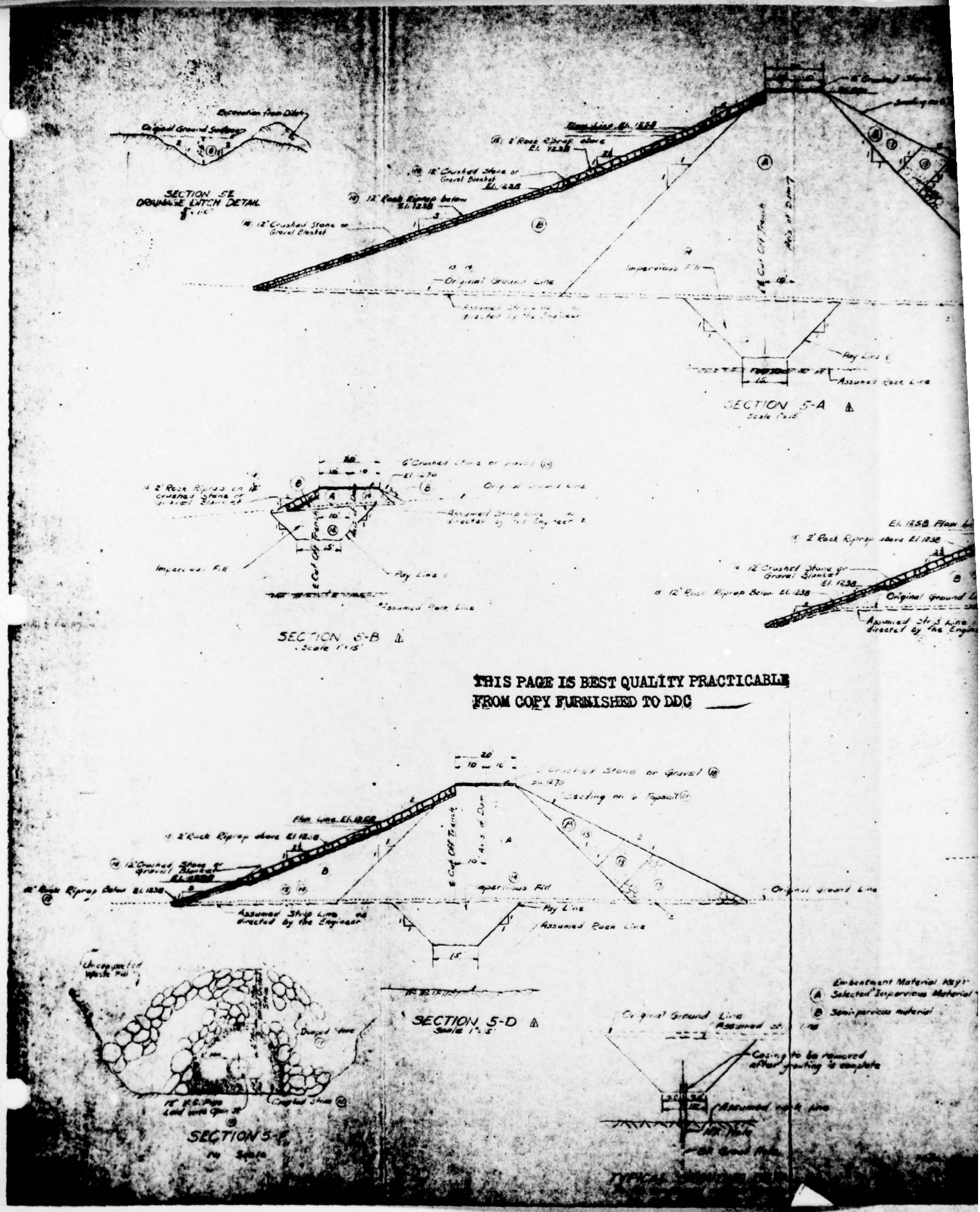
TYPICAL CONDUIT SECTION II

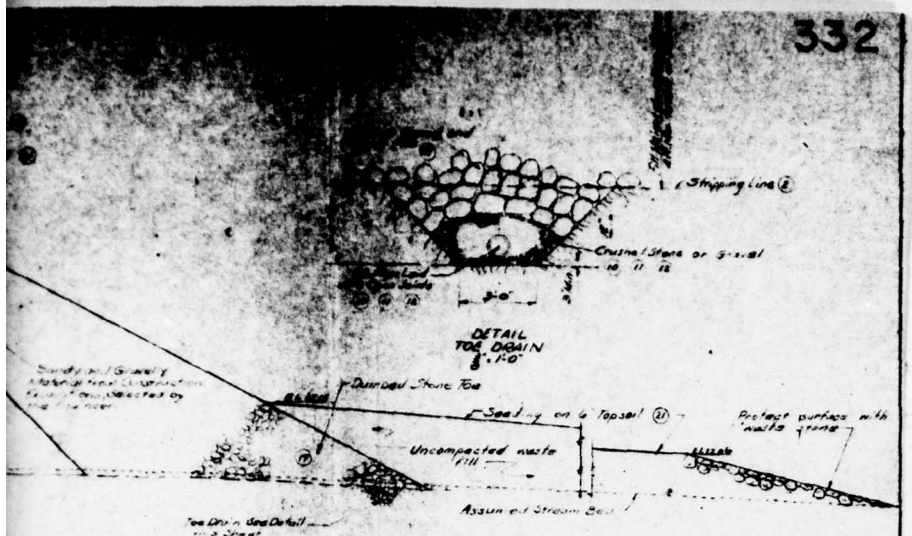
PLATE VI

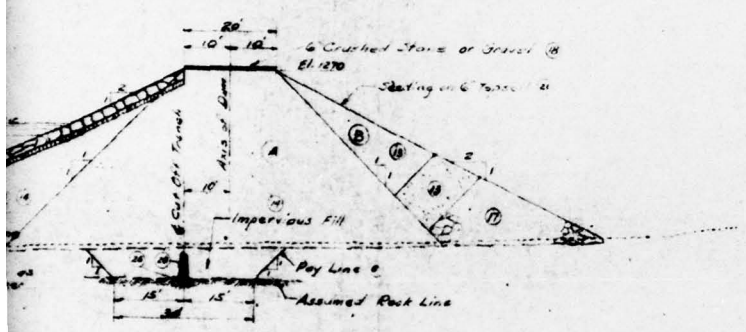
DRAWN	WAYNESBORO BOROUGH AUTHORITY	SHEET NO. 7
TRACED		
CHECKED	ANTIETAM DAM	JOB NO.
APPROVED	CONDUIT DETAILS	DATE
APPROVED J.B.C.		

GARRETT FLEMING GOODDY & CARPENTER, INC.
ENGINEERS
600 N. SECOND ST. HARRISBURG, PENNA.

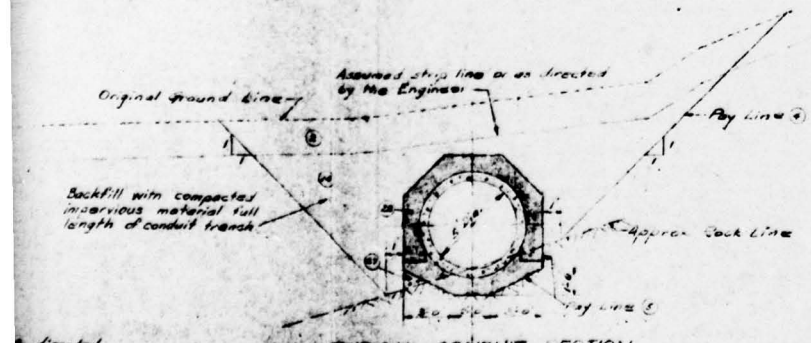
REVISIONS			
NO.	DESCRIPTION	DATE	BY







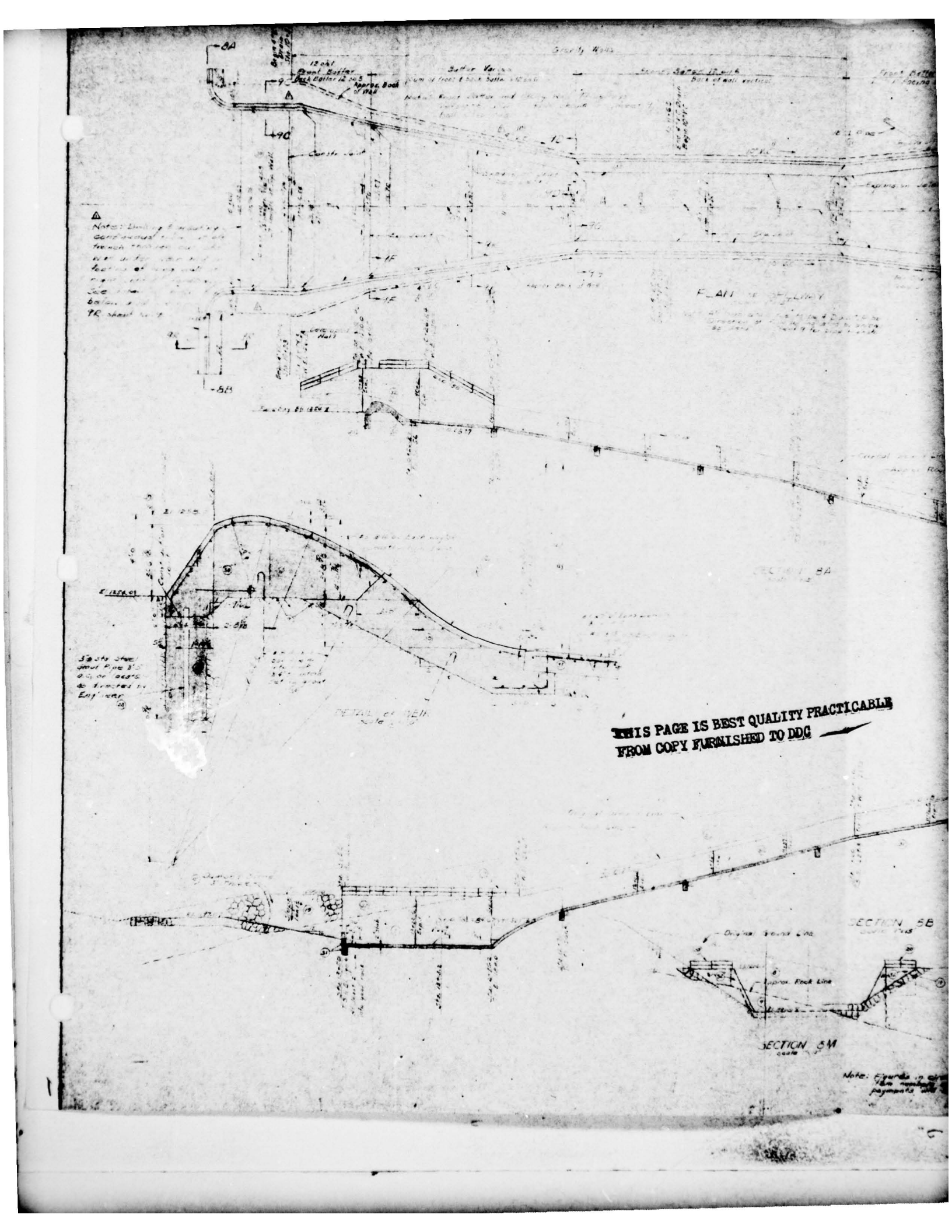
SECTION 5-C
Scale 1"=15'

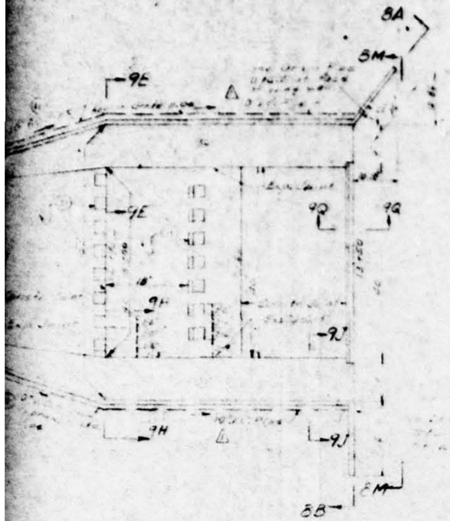


TYPICAL CONDUIT SECTION
SHOWING PAY LINE LIMITS
Scale 1"=10'

PLATE VII

	WAYNESBORO BOROUGH AUTHORITY WAYNESBORO, PA ANTIETAM DAM DAM SECTIONS	SHEET NO. 5 OF 12 JOB NO. 1894





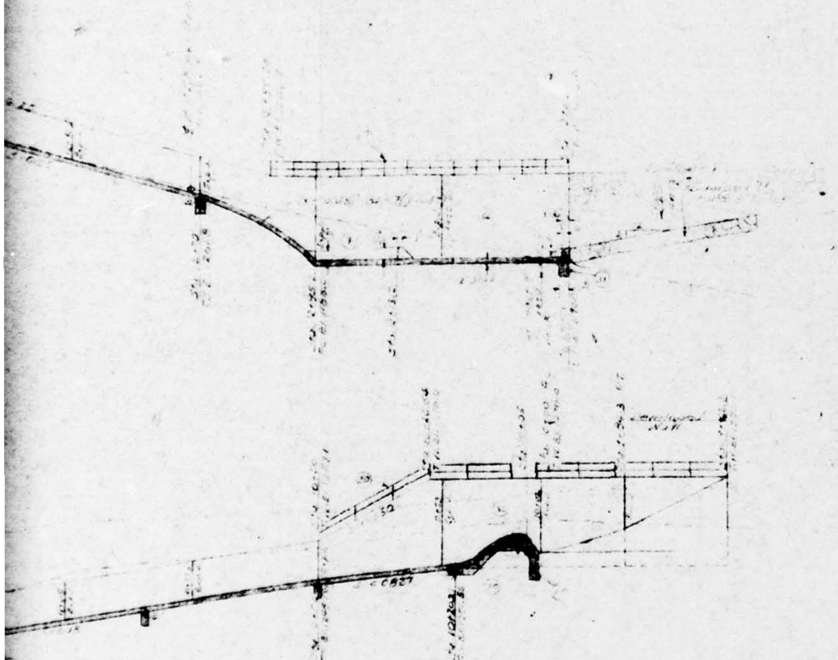


PLATE VIII

DRAWN	WAYNESBORO BOROUGH AUTHORITY	SHEET No
TRACED	WAYNESBORO, PA	3 of 12
CHECKED LAG	ANTIETAM DAM	JOB No 1894
APPROVED	SPILLWAY PLAN	DATE
APPROVED J.B.C.	AND PROFILES	DEC. 1951

ENGINEERS

HARRISBURG, PENNA.

REVISIONS

No	DESCRIPTION	DATE	BY
△	Changed [illegible] walls to gravity and	7-2-52	ALG
	Added drops - Changed slab joints		
	[illegible]		